

NEW AND OLD OBSERVATIONS
ON CERATOPOGONINE MIDGES
ATTACKING OTHER INSECTS

BY

F. W. EDWARDS

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During the last two decades a fairly extensive literature has been published in regard to the attacks made by Ceratopogonine midges upon other insects. Several cases were placed on record by Knab (1914), who also reviewed the literature published previously to this date. More recently the facts have been reviewed by Peyerimhoff (1917) and Kieffer (1922), the former author adding some very interesting observations of his own. There are, however, one or two additional and very interesting cases which have been overlooked by all the above-named writers, and also some further unpublished instances which have come to my notice. It may, therefore, be worth while, in recording the fresh cases, to review again the literature of the subject.

The attacks made by midges upon other insects fall under two main heads:—

(1) *Cases of predacity*, where the midges attack other adult insects of approximately their own size, or not much larger, and kill them by puncturing their skin and sucking them dry. A good many instances of this have been noted, and I have summarised them in a recent paper (1920).

The following list gives the names of these species and of their victims:—

PREDATOR	VICTIM
	<i>NEUROPTERA</i>
<i>Palpomyia flavipes</i> , (Mg.)	Ephemerid (<i>Baetis</i> sp.)
" sp.	Perlid
	<i>CHIRONOMIDAE</i>
<i>Bezzia annulipes</i> (Mg.)	<i>Tanytarsus sylvaticus</i> , v.d. Wulp.
<i>Probezzia multiannulata</i> (Strobl.)	<i>Culicoides circumscriptus</i> , Kieffer.
<i>Probezzia</i> ? <i>signata</i> (Mg.)	<i>Culicoides pulicaris</i> (L.)
<i>Stilobezzia gracilis</i> (Hal.)	<i>Cricotopus pulchripes</i> , Verr.
" "	<i>Orthocladius</i> sp.
" "	<i>Tanytarsus</i> , 2 spp.
" "	<i>Tanytus binotatus</i> , Mg.
<i>Serromyia femorata</i> (F.)	<i>Cricotopus pulchripes</i> , Verr.
" "	<i>Bezzia ornata</i> (Mg.)
" "	<i>Serromyia femorata</i> (F.) ♂
* " "	<i>Trichocladius</i> sp.
† <i>Ceratopogon candidatus</i> , Winn.	<i>Trichocladius</i> sp.
<i>Ceratopogon lacteipennis</i> , Zett.	<i>Camptocladius</i> ? <i>gracilis</i> , Goet.
" "	<i>Culicoides arcuatus</i> (Winn.)
" "	<i>Ceratopogon lacteipennis</i> Zett., ♂

In addition, Kieffer (1922) quotes Loew to the effect that *Macropeza albitarsis*, Mg., preys upon other small insects.

This list could no doubt be greatly extended by careful observation, and it seems probable that all the members of the bare-winged genera of *Ceratopogoninae* are normally predaceous in the female sex. Evidently the various modifications of the legs, such as swollen and often spiny femora, enlarged claws and spines on the last tarsal segments, which the females of most of these genera exhibit, are to be regarded as adaptations for holding their insect prey. It is probable that these predaceous habits are primitive in this sub-family, and that they have directly or indirectly led to the more specialised blood-sucking habits of certain species and genera.

Although it is beyond the scope of this paper, attention may be called in passing to the observations of Ingram, who found in West

* Noted in North Cornwall, June, 1922. This is the only fresh record I have to add to the list previously published.

† Goetghebuer's review (1922) of the *Ceratopogoninae* in Meigen's collection has made it clear that *C. communis*, Mg., the type of the genus, belongs to Kieffer's genus *Psilobelea*; this name, therefore, falls as a synonym of *Ceratopogon*. As I have stated in a recent paper (1921) I do not consider the differences between *Ceratopogon* (*Psilobelea*) and *Isobelea* are of more than subgeneric value, hence I include *I. lacteipennis* and its allies also in *Ceratopogon*.

Africa the larvae of *Forcipomyia ingrami*, Carter (1919), attacking mosquito larvae. This is, I believe, the only known instance of predacity in a *Ceratopogonine* larva.

(2) *Cases of blood-sucking*, where the attacking midge sucks the juices of its victim, without as a rule killing it, the victim in such cases being generally much larger than the attacking species. It is this class of phenomena with which I wish to deal more particularly in the present paper. Following the example of Peyerimhoff (1917), we may consider these midges in several groups, according to the type of host which they attack.

I. SPECIES ATTACKING MOSQUITOES

A considerable number of observations have been made on the relations between adult mosquitoes (generally *Anopheles*) and a species of *Culicoides* which is widely spread in the Oriental region. In a recent paper (1922) I have summarised these observations, and have described the midge concerned as *Culicoides anophelis*. It appears that the object of the *Culicoides* is to obtain engorged blood from the abdomen of its host, though it has in some cases been found to have attacked mosquitoes which were not engorged. At present only this single species of *Culicoides* is known to have these very remarkable habits.

This extremely interesting case may be regarded in one of two ways. It may be a development directly from a primitive predacity; the species having passed from a diet of (say) *Chironomidae* to one of mosquitoes, and thence to the mammalian blood contained in the body of its host. In this case it is easy to imagine that the midge might follow its mosquito host to its feeding ground, and eventually take to sucking blood itself directly from the mammal, thus giving rise to the blood-sucking habits now so general in the genus *Culicoides*. The possibility of this having been the course of development is somewhat strengthened by the fact that *C. anophelis* appears to show some somewhat primitive characters, such as the simple wing-pattern and rather large radial cells. On the other hand, it may be that the habit of obtaining blood from mosquitoes is purely secondary, and derives from an ordinary direct method of blood-sucking; this is, perhaps, most probable, since Lamborn's observations seemed to show that a blood meal was essential to the production of a complete fertile batch of eggs.

II. SPECIES ATTACKING ADULT LEPIDOPTERA

One instance has been recorded (by Kryger, 1914, quoted also by Knab, 1914) of a midge attacking a moth. The host was *Cidaria didymata*, L.; the midge was not precisely identified, but was stated by Knab to be apparently an undescribed species, 'belonging in the neighbourhood of *Ceratopogon murinus*, Winn.' In the hope of obtaining some further information concerning this species, I wrote to Mr. Kryger in Denmark, and also to Messrs. Aldrich and Böving in Washington, but only to discover that the material had been lost.

A second very similar case was discovered by Professor Newstead in North Wales in 1914, and I am greatly indebted to him for kindly allowing me to examine and describe the material of this most interesting find. While collecting at night with the aid of an acetylene lamp, Professor Newstead came across a cabbage-white butterfly whose wings were being attacked by nine specimens of a *Ceratopogonine* midge. The butterfly was considerably damaged, and as is shown by the accompanying photograph (fig. 1) the



FIG. 1. *Pieris napi* (slightly enlarged), victim of *Forcipomyia* (*Euforcipomyia*) *papilionivora*, Edwards. The left forewing, just below the costa and along both sides of the large vein, shows the nature of the damage, caused by the midges

damage would seem to have been caused, at least in part, by the attacks of the midges.* The latter appeared to be eating the wings

* Blood was seen exuding from the ruptured veins when the insect was captured; and the scales on either side of the veins are stained russet-brown, due apparently to the exudation. When first imprisoned the midges left their victim and swarmed over the glass lid of the collecting box; but on placing them in the dark, they were found, two hours later, to have resumed their attacks on the butterfly. (R. Newstead).

of the butterfly, though, as in the case of the Danish insects, they may in reality have been sucking juices from the wing-veins, especially if the blood was exuding from the broken ends of the veins.

After a careful examination of the literature, I have come to the conclusion that the midges collected by Professor Newstead belong to an undescribed species, and I, therefore, name and describe it as follows:—

Forcipomyia (Euforcipomyia) papilionivora, sp. n.

Head rather densely clothed with golden pubescence. Eyes practically touching, perfectly bare. *Antennae* uniformly dark, flagellum clothed with longish dark hair, nearly twice as long as the diameter of the segments. First eight flagellar segments together much shorter than the last five together (proportions 3 : 5). First flagellar segment nearly globular, the next five slightly transverse, seven and eight again practically globular, nine to thirteen each nearly three times as long as broad, thirteen with a nearly globular, nipple-like tip; one to eight each with rather long and stout sense-bristles, difficult to observe. *Palpi* dark, the second segment oval, broadest in the middle, not quite twice as long as its greatest breadth, apical part not suddenly narrowed; last two segments together as long as the second, the fourth a little longer than the third. Second segment with a globular internal cavity opening by a small round pore on the inner face. *Mandibles* broad, about three to five times as long as their greatest breadth, tip rather bluntly rounded, with about twelve to fifteen small, equal-sized teeth on one side; in the middle is an oval clear spot enclosing an elongate dark mark, resembling that figured by Carter, Ingram and Macfie in the genus *Prionognathus*. *Maxillae* almost as long as the mandibles, with about twenty-five fine regular crenulations, scarcely teeth, on one margin. *Hypopharynx* rather elongate, oval, a little over twice as long as broad, tip smooth. *Thorax* with the integument dull blackish, the humeral angles and the whole scutellum dull yellow. *Mesonotum* densely covered with short, bright golden pubescence mixed with longer, but not very long, brownish hair. Scutellum similarly but less densely clothed, postnotum shining black. *Abdomen* rather narrow for the genus, dull dark brown, uniformly clothed with short blackish hair. *Spermathecae* large,

nearly globular, necks practically without chitination. Cerci dark. *Legs* slender, practically uniform in colour, rather dark brownish, very hairy, the tibiae with some long hairs which are about six times as long as the tibial diameter. On all the legs the first tarsal segment is 2.5 times as long as the second. Empodia well developed, almost as long as the claws. *Wings* clothed rather densely (but somewhat less densely than in most species of the genus) with close-lying dark hair; most of the hair on the thick veins golden, but mixed with some dark. Venation normal for the genus: R_5 in contact with R_1 , so that the first radial cell is obliterated; second radial cell about twice as long as broad, trapezoidal; petiole of median fork a little shorter than the very oblique r-m; cubitus forking below end of costa, which reaches just beyond the middle of the wing. *Halteres* with the stem dark, the knob white.

Length of body, 1.8 mm.; wing, 1.4 mm.

NORTH WALES: Ty Gwyn Farm, Aberhosan, Machynlleth, found at 10.15 p.m. feeding on the wings of *Pieris napi* (R. Newstead). Three ♀ co-types in the British Museum, presented by the collector; six others in the collection of the Liverpool School of Tropical Medicine.

This insect seems to have no very close ally among the European species. By Kieffer's table it will run down to *F. formicaria* (Kieff.), which differs in having the first tarsal segments much shorter, as well as in the palpal structure and other details. Other European species which show some points of resemblance are *F. hirta* (Lundst.) and *F. murina* (Winn.), but none show the combination of antennal and tarsal characters possessed by this species. In both these respects the new species resembles *Lasiohelea velox* (Winn.), but it has not the venation of the genus *Lasiohelea*; it belongs to Malloch's group *Euforcipomyia*, and bears a close resemblance to the North American *E. fusicornis* (Coquillett) (see below).

From the above remarks it will be seen that the specimens collected by Professor Newstead might have been referred to as 'an undescribed species belonging in the neighbourhood of *Ceratopogon murinus*, Winn.,' and it, therefore, seems not improbable that the Danish specimens found by Mr. Kryger may have belonged to the same species. In any case, it is interesting

to note that the only two records we have of midges attacking adult *Lepidoptera* both refer to an insect belonging to the same group of the genus *Forcipomyia*.

III. A SPECIES ATTACKING A SIALID

Malloch (1915) states that he has seen a specimen of *Euforcipomyia fusicornis* (Coquillett) which was taken attacking a Sialid (*Chauliodes* sp.). In view of the large size of the victim, this must be classed as a case of blood-sucking rather than of predacity. It is not stated what part of the Sialid was attacked, but it is evident that we are here dealing with a very similar case to the two last considered, *Chauliodes* being a large-winged, rather soft-bodied insect, comparable with a moth. It is, therefore, of special interest to note that *E. fusicornis*, according to Malloch's description, bears a very close resemblance to the species just described as *F. papilionivora*. In fact, it is not impossible that the two may be conspecific, though it seems unsafe to identify a European with a North American form without actual comparison of material.

Although I do not consider *Euforcipomyia* to be generically distinct, it may be retained as a sub-genus in the sense in which Malloch proposed it: i.e., to include the species of *Forcipomyia* which have the first hind tarsal segment markedly longer than the second, reserving *Forcipomyia* (*s. str.*) for those species in which the first is shorter, or at most slightly longer, than the second. This is not the sense in which Kieffer has used the name, but seems to be the correct one, since the type species of *Forcipomyia* is *bipunctata*, L. (*trichoptera*, Mg.), not *albipennis*, Mg., as stated by Kieffer.

IV. SPECIES ATTACKING CATERPILLARS

A number of cases of midges attacking caterpillars have been recorded from time to time. Most of these were referred to by Knab (1914), the cases he mentioned being as follows:—

SPECIES	HOST	OBSERVER
<i>Forcipomyia propinqua</i> (Will.)	<i>Melanchroia geometroides</i> (Waker) (<i>Geometridae</i>)	Baker (Cuba)
<i>F. squamosa</i> , Lutz.*	Sphingid (undetermined)	Townsend (Peru)
<i>F. sp.</i>	Sphingid (undetermined)	Barbiellini (Brazil)
<i>F. crudelis</i> , Knab.†	Not stated	Urich (Mexico)
<i>F. erucicida</i> , Knab.	<i>Erinyis ello</i> L. (<i>Sphingidae</i>)	Mosier (Florida)

* Specific name given by Lutz (1914).

† This specific name is preoccupied by *F. crudelis* (Karsch), but I refrain from proposing a substitute because the descriptions appear to indicate that the species is almost certainly identical with *F. tropica*, described by Kieffer (1917) from Costa Rica.

All the above-named species of *Forcipomyia* belong to that group of the genus in which the female tibiae are devoid of scales, and the second segment of the hind tarsi is at least twice as long as the first. The same remark is true of three other species which were not known to Knab, and are discussed below. It would seem, therefore, that the habit of attacking caterpillars is a very special one, restricted to this group of the genus *Forcipomyia*.

Forcipomyia crudelis (Karsch, 1886)

This species was described from a single female found by Karsch sucking a saw-fly larva in the neighbourhood of Berlin. He remarks that his attention was called to the larva by the movements which it made in endeavouring to dislodge its tormentor, and that the latter had its mouth-parts so firmly fixed in the body of its victim that it did not loose its hold even when the pair were placed in the cyanide bottle. *F. crudelis* has not been recognised since Karsch described it, but it is evidently very closely related to *F. pallida* (Winn.), *F. brevimanus* (Lundst.) and *F. alboclavata* (Kieffer).

Forcipomyia hirtipes (de Meij.)

Two females of this species were found by Mr. J. C. F. Fryer (recorded by me, 1913), at Peradeniya, Ceylon, each sucking a larva of *Papilio clytia*. *F. hirtipes*, it is interesting to note, closely resembles the European *F. alboclavata*, showing only very slight differences in the proportions of the palpal and tarsal segments. The Ceylon specimens do not agree with de Meijere's description, as regards the middle tarsi; but, as he has informed me, the description is incorrect. In reality, he says 'the mid-tarsal segments have about the same proportions as the hind, viz., in ♂ about 8 : 30 : 14 : 11 : 8, in ♀ about 9 : 25 : 11 : 9 : 8.' He also informs me that though the antennae of the type ♀ are mutilated, in another specimen the proportion of the first eight to the last five flagellar segments is about 27 : 38. These proportions are about the same as in the Ceylon specimens.

Forcipomyia alboclavata (Kieffer, 1919), (*canaliculata*,
Goetghebuer, 1920)

The British Museum possesses three ♀♀ of this species from Taterafuered, Hungary, 1906 (*Hon. N. C. Rothschild*), on which

the donor sent the following note:—‘Sitting on the backs of larvae of *Deilephila galii* (which were extremely common in a large field near Taterafuered), and appearing to eat some secretion from their skins.’ The specimens have the second hind tarsal segment 2.5 instead of only twice as long as the first, but otherwise agree with Keiffer’s description, and I have no hesitation in quoting the synonymy as above.

F. alboclavata has been found in Scotland (Arran) as well as Belgium, but its habits in these countries have not been observed.

V. SPECIES ATTACKING OIL-BEETLES

Peyerimhoff (1917) has given an interesting account of the relations between a Ceratopogonine midge (at present undetermined) and the oil-beetle *Meloe majalis*, L., in Algeria. The flies, he says, pursue these large beetles in little swarms, and without inconveniencing them in any way, feed upon their yellow blood. M. de Peyerimhoff informs me that the flies are now in the hands of Professor J. J. Kieffer, who believes that they represent a new species.*

More recently, a second similar instance, this time from Denmark, has been recorded by Hansen (1921). I am indebted to my friend, Mr. J. P. Kryger, for the following translation of Mr. Hansen’s note:—

‘A gnat attacking a *Meloe*—29th May, 1921. I saw a *Meloe proscarabaeus* crawling along a walk in the wood of Ulvlyst (Denmark). A little swarm of gnats hovered over the beetle and sometimes attacked it, especially on the soft skin between the first and second thoracic segments. The beetle was seriously affected by the gnats biting, and rubbed its sides with its hind legs, but without getting rid of its tormentors. When I put the collecting bottle over the beetle two gnats were sitting on its back, but as it tumbled in twelve gnats appeared in the bottle. The remaining ten must have been sitting on the underside of the beetle.’

Mr. Kryger has further been so good as to obtain for me the loan of the specimens captured by Mr. Hansen, which had been

* Since this was written I have received, through the kindness of Professor M. Bezzi, a number of the specimens originally collected by M. de Peyerimhoff. Without trespassing on ground to be covered by Professor Kieffer, I may remark that these specimens represent a species which is extremely nearly related to *Atrichopogon rostratus* (Winn.), a fact which is of much interest in view of my determination of the Danish specimens.

presented by the collector to the Zoological Museum at Copenhagen. Upon examination of the flies I find that they belong to the species *Atrichopogon rostratus* (Winn.), all, of course, being females. The purpose of the formidable proboscis possessed by this species thus becomes apparent for the first time, for neither it nor any other member of its genus has been known either to bite warm-blooded animals or to prey upon other small insects. But, as in the case of many other midges with strong food preferences, the diet of *A. rostratus* is not confined to the blood of *Meloe*, but consists partly of vegetable substance (honey, or perhaps pollen). All the adult specimens of this midge which I have found myself have been taken on the flowers of umbellifers (*Angelica* and *Heracleum*), often in company with great numbers of some other species of *Atrichopogon*.

VI. A SPECIES ATTACKING A PHASMID

Williston (1908) mentions a minute fly which was found in the West Indies 'closely applied to and apparently sucking the juices from the antennae of a Phasmid.' He considered the specimen to represent a new genus of *Simuliidae*, but the figures which he gives indicate rather a Ceratopogonine midge. The available evidence is insufficient to place this species generically, though if Williston's figure of the wing is accurate, it would not seem to fit very well into any known genus. The specimen is not among the West Indian collections in the British Museum which were studied by Williston, and I am informed that it cannot be traced in those parts of his collection which are now in Washington and New York.

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